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NEW CRINOIDS FROM THE ROCKS OF THE CHEMUNG PERIOD OF NEW YORK STATE.

BY HENRY S. WILLIAMS, PH. D.

Hitherto the rocks of the Chemung period have furnished only imperfect traces of crinoids. Joints of the stems are frequently met with, in some places in great numbers, but we find mention of only three crinoids in condition sufficiently perfect for specific identification.

Cyathocrinus ornatissimus was described by Professor Hall in 1843 (Geol. Rept. of 4th Dist. N. Y. State, p. 247), from the Portage group at Portland, shore of Lake Erie, N. Y., but the description and figures leave the generic and family relations of the species in doubt, and we find no mention of the name in the exhaustive "Revision of Palæocrinoidea," of Wachsmuth and Springer, 1879–1881.

Taxocrinus (*Forbesiocrinus*) *communis* Hall and Whitfield, is recognized in a specimen from the Chemung group at Forestville, Chautauqua Co., N. Y. (see Palæontology of Ohio, vol. ii, p. 170). The original locality for the species is the shales of the Waverly sandstone of Richfield, Summit Co., Ohio.

A third species, *Platycrinus Bedfordensis* Hall and Whitfield, is described from the upper part of the Erie shales of Ohio, which are regarded by some good authorities as equivalents of the Portage and Chemung rocks of New York. These three are the only crinoids specifically identified from rocks of the Chemung period, or their equivalents, up to the present time.

The specimens from which the following species have been determined are mostly in the condition of moulds from which the original substance of the fossil has been entirely removed, and in such cases, casts of wax or gutta percha have been used in the description of the species.

In a few cases the material is in such an imperfect condition that a proper specific diagnosis is impossible, and accordingly no specific name has been assigned, although mention is made under the generic name of such new characters as could be observed.

In other cases a large number of individuals has been found in a single locality, among which certain variations are noted, and by comparison of all the specimens these variations are found to be pure variations and not marks of distinct species. Crinoids are generally so rare in individual specimens that it is believed that any contribution to our knowledge of the direction and extent of the variations among the individuals of a common species is of value to palæontologists.

The author expresses his thanks to Mr. Charles Wachsmuth for valuable suggestions and assistance in the identification of genera, and to Profs. John M. Clarke and S. G. Williams for the loan of specimens.

The types of the species, not otherwise designated, are from the author's collection, and will be placed on deposit in the museum of Cornell University, Ithaca, N. Y.

Poteriocrinus Cornellianus n. s. Pl. I, figs. 1, 2 and 3.

Calyx cup-shaped; arms very long; stem pentagonal and expanding at the top, under the calyx.

Underbasals small, difficult to distinguish from the final segment of the stem; junction between the several plates indistinct and in line with ridges of the stem.

Basals large, hexagonal, height and breadth subequal.

Radials large, broad, longitudinally convex, and incurving toward the vault, the edges of two adjacent radials forming a deep groove which terminates upon the upper part of the basals. The broad convex ridge, which begins on the radials, is continued in the brachials and arms up to the first bifurcation, and is in direct line with the five angular carinations of the upper part of the stem. The upper margin of the radial, straight, broader than the first brachial.

The radial is succeeded by a single series of eight (or nine) plates, of nearly uniform size, and dorsally with no lateral expansion, strongly convex, the last plate angular above, and presenting two oblique faces from which proceed two smaller arms. These arms bifurcate a second time in the course of their length. The general appearance is that these first eight plates above the radial are brachials. But, we observe, from the ventral part of the sides of each of these plates arise pinnules on alternate sides, beginning with the third or second plate of the series.

If, therefore, we regard the presence of pinnules as a mark of the arm-plates, in distinction from brachials proper, we have here two or three brachials followed by a single series of arm-plates, six or seven in number (the number of these plates varies for the rays of a single specimen), with strong pinnules from each plate; from the last of this series branch off two subequal rays which again bifurcate.

The arms above the bifurcation are long and thickly beset with pinnules, one from each joint; occasionally a plate is intercalated without a pinnule, but the pinnules retain their alternate order.

In the middle and upper part of the arm the joints are somewhat produced on the side where the pinnules arise. Anals, three within the calyx; the lowest touches two basals, the right posterior radial and the second and third anals. The second anal lies upon the left of the first and touches the left posterior radial. The third anal is directly above the first, and touches the radial on the right, the second anal on the left, and is succeeded by a series of plates very similar (on the dorsal view) to the lower arm-plates, but with no pinnule and with straight articular faces. This is the ventral tube. This ventral tube is very long, apparently as long as the arms, but more even in size throughout.

In the typical specimen, what is preserved of this tube is one-third the length of the arms; laterally it is beset on both sides by a fringe, about the width of the plates themselves, of narrow ridges and furrows perpendicular to the axis of the tube. There are four to six of these furrows in the length of each plate, and they continue uninterruptedly the whole length of the tube. In another specimen the tube has been preserved lying mainly outside the arms, and thirty-one plates can be distinctly seen, making a tube whose length is six times the diameter of the calyx; the final plate is about half the size of the first one. A study of the specimens at command—although all but one are in the condition of moulds in fine sandstone from which the original material is entirely removed, has enabled us to make out the general external details of structure of this "tube," (Pl. I, fig. 3, *a*, *b*, *c*, *d*.)

The dorsal aspect is that of a cylinder, from a little below the centre of which extend outward and downward lamellæ which on each side are continuous; the junction at each joint of the plates is not visible, and transversely they are marked by narrow furrows. A section shows these fringe-like lamellæ to be lateral expansions of the axial plates, thickened at the outer margins and on the ventral side terminating at a narrow, medium, longitudinal keel, which appears to be composed of two series of minute plates alternately arranged. The transverse striæ do not continue over the outer margin to the ventral side, but reappear in the furrow at the base of the ventral keel.

This is all that can be determined from the specimens, which show only the outside cast of the tube. Whether the transverse striæ are marks of external furrows, or of narrow perforations, or whether this be the whole of the tube, which was hollow, or an axis upon which softer tissues were engaged, are indeterminate from these specimens.

Dimensions.—Stem, diam. at top, 3.0 mm., below, 2.8 mm.; calyx, diam., 7.0 mm.; arm at base, diam., 2.0 mm.; primary radial series, length, 5.1 mm.; arms, length, 45.0 mm.; arms, first five joints at base, 6.–6.6 mm.

Locality.—Ithaca, N. Y.

Horizon.—Chemung group, 200 ft. above base.

One of the finest specimens of this species was collected by Mr. A. H. Cowles (C. U., '82), of Cleveland, Ohio, and presented to the author. It is taken as the type of the species.

The species is not uncommon, in the condition of stems and fragments, in Cornell University quarry, and in the same stratum at other outcrops, but the heads or even arms are very rare.

[1] Poteriocrinus *sp. prima*).

Two nearly perfect arms were found by the author on a fragment of rock, from cliffs of the upper Portage, which differ from any species known, but are not enough for specific diagnosis. The size and general appearance are those of *Poteriocrinus Cornellianus*, but it differs in the arrangement of pinnules, which appear regularly on each side from every fourth joint.

The pinnules are shorter and more slender than those of *P. Cornellianus.*

Locality.—Ithaca, N. Y.

Horizon.—Portage group (?); from slab not in place but probably from this formation, or just above.

[1] To avoid the necessity of establishing new specific, or varietal names upon inadequate evidence, use is made of the denominations *species prima*, *sp secunda*, etc., under the appropriate genus, and *varietas alpha*, *var. beta*, etc., under the appropriate species as a means of designating new facts, whose taxonomic relationship cannot be satisfactorily determined from the material at command.

Poteriocrinus Clarkei n. s. Pl. I, fig. 4.

Calyx obconical, small, gradually expanding from the top of stem, which also gradually expands and the calyx continues evenly the rate of increase in size begun in the stem.

The radials are very convex in the centre, making a conspicuous enlargement at this point.

Underbasals of medium size, pentagonal, as high as wide.

Basals large, hexagonal, higher than wide, and twice the height of the underbasals. Radials of medium size, truncate above, irregularly pentagonal, smaller than the basals, wider than high, externally quite gibbous.

Brachials, two for each ray.

The first brachial short, cylindrical, with a straight margin above and below, height and width equal, much narrower than the radial; second brachial cylindrical, and at the base the same size as the first brachial, but near the top it suddenly expands to nearly double width, angular above, bearing two arms which do not bifurcate. In one specimen one of the second brachials bears three arms each of equal and normal size.

The joints between the primary radial plates gap, as do also, in some specimens, those of the arm-plates.

The brachials are free, parallel, and separated by a space as great as their diameter.

The surface of the calyx is marked by two rows of depressions; the first is elongate, longitudinally, its bottom lies along the suture between contiguous basals, takes in the point of the underbasal and the lower part of the radial; near the top of this groove is a horizontal ridge not reaching the general surface, but uniting the two walls of the groove, and it is more prominent in some specimens than in others.

In the second row, the depressions are smaller, triangular, pointed below, and have their centres over the angle of meeting of the basal and two approximate radials; each cavity extends upon the edges of each of these three plates.

Stem, above pentagonal with thin disks, below gradually becomes cylindrical, and the disks elongate till their length equals half the diameter, are not convex but form a smooth cylindrical stem; from this part cirri are frequent, standing at right-angles to the stem.

Anals not known.

This species resembles *Pot.* (*Scaphiocrinus*) *Whitei* Hall, '61,

p. 306, but differs in the longer body, column more rapidly expanding at the top, larger calyx, the basals being larger in proportion, and in the presence of two brachials instead of one; also, the arms do not branch, so far as determined from the specimens, and the plates are not conspicuously prominent at the offset of the pinnules. The surface markings are much alike in the two species, but there are several other species similarly marked.

Dimensions.—Calyx, height, *a* 4.5 mm., *b* 4.4 mm.; width. *a* 5.1 mm. *b* 5 mm.; stem, diam. at base of calyx, *a* 2.4 mm., *b* 2.4 mm.; diam. lower down, *a* 1.4. mm.; primary radial series, height, *a* 5.2 mm., *b* 4.1 mm.; first brachial, diam. *a* 1.3 mm., *b* 1.2 mm.; first arm-plate, diam., *a* 1.1 mm., *b* 0.9 mm.; first five arm-plates, length, *a* 7.9 mm.

Locality.—Haskinsville, Steuben Co., N. Y.

Horizon.—Chemung group.

Collected by, and named for, Prof. J. M. Clarke, of Smith College, Northampton, Mass.

Poteriocrinus Clarkei, var. alpha n. v. Pl. I, fig. 5.

This variety is based upon the impression of part of a calyx found by the author at Ithaca, N. Y., in the lower part of the Chemung group.

It is about twice as large as the Haskinsville specimens, and the pittings of the surface are more strongly marked. The cross-bar in the upper part of the long grooves is particularly strong in comparison, but in shape and proportion of plates, the differences are so slight that we provisionally regard this as a variety of *P. Clarkei.*

Locality.—Ithaca, N. Y.

Horizon.—Chemung group, lower part.

Poteriocrinus (Decadocrinus) gregarius n. s. Pl. I, figs. 6, 7, 8.

Underbasals minute.

Basals hexagonal, twice the size of the underbasals, as wide as high, the angles not sharply defined.

Radials about same height as basals, but broader and pentagonal, with the upper margin only slightly concave.

First brachial four-sided, longer than broad, and expanding toward the top, the upper margin conspicuously concave; base, same width as upper edges of radial.

Second brachial pentagonal, base convex and narrow, breadth increasing to the top, where the width is equal to the total height of the plate, the two upper edges standing obliquely at about a right-angle, and subconcave.

Surface of calyx and arm-plates smooth and gently convex.

The rapid enlargement of the consecutive series of plates up to the brachials forms a low, expanded cup. The first plates of the arm are a third smaller than the terminal part of the stem just under the calyx.

The arms are long, ten in number, and do not branch ; each arm-plate bears a pinnule. Pinnules are arranged alternately on each side of the stem, and occasionally a plate appears without pinnule, but the alternate order of the pinnules is not broken. The first five or six arm-plates are cylindrical, about the length of the last brachial, and, dorsally, show little extension, either laterally, or longitudinally at the point where the pinnules are attached, but after the fifth, the side from which the pinnule starts is slightly higher and extends laterally more than the other. The centre of length of the arm of the fully developed individual is at the tenth or twelfth plate, and here the plates are a third longer than their average diameter, and the pinnules are strong, gradually tapering to a point and composed of ten or twelve plates (or six to eight in the shorter pinnules) ; the first one is about half the size of the base of the arm-plate, from which it springs.

The arms are spreading, and an occasional specimen is found spread out radiately upon the surface of the slab.

The anals, and succeeding plates of the ventral tube, are not apparent on all specimens, but from examination of all the material at hand, we conclude that the arrangement of the proximal plates of the series is that normal to the genus *Poteriocrinus*, as defined by Wachsmuth and Springer, but the origin is frequently higher up in the calyx. In several specimens the anals do not reach the basals, but begin on the slopes of the two adjoining radials, which meet under them ; but one specimen, which appears very well preserved, without distortion, has the normal arrangement of anals, three plates being in contact with calyx plates; the lowest lies a little to the right, between the adjacent, upper, sloping edges of two basals ; above these anals can be distinctly seen, three or four plates in each of the two series of the ventral tube. The irregular position of the anals among the calyx plates possibly may be accounted for by distortion of the specimen by pressure, but this is not self-evident, but inferred to explain what appears to be abnormal. Attention is drawn to the fact to show that species or genera established upon single or few imperfect specimens are not always to be relied on.

The stem is composed of discoid segments, externally convex and serrate at their union; arranged in two sets, one thinner than the other, in alternate order. The difference is greatest near the base of the calyx, where also the plates are thinnest; the thickness (or length) of the individual joints increases with distance from the calyx; the size of the stem slightly diminishes, and the difference between the two sets becomes obliterated, until the joints reach a length equal to their diameter, and the serrate union is inconspicuous, the outer surfaces becoming very convex. This latter is the common character of the central part of the stems, the joints being subglobular and of uniform size. Slender cirri proceed from all along the stem; they have been observed within an inch of the calyx, and are generally found rather closely coiled at their ends.

The upper part of the stem appears slightly pentagonal, but the angles are rounded and within an inch of the base of the calyx all trace of them is lost.

Dimensions of type specimen—which are a little greater than for the average of the specimens examined: Stem, diameter, 1.3 mm.; calyx, width, 2.3 mm.; arms and body together, total length, 21.6 mm.; primary radial series, height, 3–3.3 mm.; second brachial, width, greatest, 1.4 mm., average, 1.2 mm.; first five arm-plates, length, 4.1 mm.; second five arm-plates, length, 5.1 mm.

Locality. – Ithaca, N. Y.

Horizon.—Chemung group, 130 feet above base.

Three varieties are noted among the numerous specimens and fragments taken from the same stratum with the type specimen.

Var. *alpha* is distinguished by its smaller size, and the arms shorter, and composed of fewer, more slender plates.

Those characters of the stem, peculiar to the terminal portion, just under the calyx, are seen for only a very short distance.

The calyx and its plates do not differ, to any appreciable degree, from those of the specific type, in number, arrangement, relative size or shape.

Var. *beta.* The calyx is large, the plates well developed, the stem as large as in the typical form, and up to the base of the arms this variety appears identical with the type of the species, but the arms are exceedingly short—not more than six plates appearing in the longest arm preserved.

One of the arms begins with two full-size plates, starting out, and in shape, like the typical form, but these plates are followed by three very slender plates, the base of the first not filling completely the facet at the top of the preceding one. The arm adjoining it has one normal-sized plate, followed by four slender plates. The other arms, as far as they can be examined, show a like arrangement, and the explanation is unavoidable, that the original arms were broken off, and were being replaced by new arms not fully developed when growth and life were stopped and the hard parts buried, and thus preserved to tell the story.

Var. *gamma.* A third variety is worth mentioning. In general characters it corresponds with var. *alpha*, but differs conspicuously in the plates of the ventral tube. At the base the anals are arranged as in the normal specimen, while the upper part appears to have special development.

There appears on the right side of the normal series of anal plates, beginning about half way up, a third series of plates about the same size as those at the corresponding height in the other series. The series, beginning lowest down, thus becomes the central one at the top, and eight plates can be counted in it. The lateral series have fewer plates, and the upper part loses itself in minute granulations at the base of the arms.

This species, of which many specimens were taken from a small locality, shows considerable variation in the length of the arms, in the number, relative size and shape of the arm-joints, in the character of the stem-joints at the base of the calyx and a short distance below until the normal characters of the stem are reached, and in the number and arrangement of the more distal part of the plates following the anals.

In these several respects the specimens under examination present hardly two which are uniform, and single specimens show more or less variation in the several rays.

There is also considerable difference among the specimens in the relative shape of the calyx and in the general arrangement of the arms, which is explained mainly by different degrees of, and direction in, compression since the specimens were buried.

The difference in the arms and arm-joints, we are led to believe, is the effect of difference of age of the specimens. Thus, we observe, in this species, that the smaller specimens have less expansion of the stem at the top, the thin disk-like stem-joints are limited to a shorter distance downward from the calyx; the arms are shorter, the arm-plates fewer, and more slender, and apparently more uniform in size and shape than in larger specimens. In larger specimens, with the more fully developed arms, we observe the plates at the base are strong, length about equal to width; in the middle portion of the arm, they are more slender and only slightly diminished in diameter; in the upper part, the plates are of a medium length, but are strongly developed on the side from which the pinnule starts, and the stem becomes more or less zigzag in shape; with all these differences, the articular faces between the arm-plates show only very slight tendency to become oblique, a character so conspicuous in other species of the genus.

The pinnules normally start from every joint first on one side, then on the other, but frequently variation is seen in this respect, by the interposition of a plate without pinnule; in some cases this occurs frequently on a single arm, giving the appearance of pinnules from every other plate. In no case is the alternate order of the pinnules disturbed by this variation.

The differences in the plates succeeding the anals appear to be purely varietal, and associated with no concomitant variation in other parts, and may be due, in a measure, to differences in state of preservation.

The normal arrangement of anals is that of *Poteriocrinus*, as given by Wachsmuth and Springer, "Palæocrinoidea," '79, p. 110, but if we regard the calyx as stopping with the top of the radial we should have several cases where the anals are entirely above the calyx, as the lowest anal lies in the angle formed by the upper oblique faces of two adjacent radials. This accounts also for a narrower calyx.

Another specimen has but a single series of anals, resting upon the upper, sloping margins of the adjoining radials, thus reminding us of *Heterocrinus*. Still a third (see var. *gamma*) starts with two series of plates at the base, which appear to reach the basal series, and opposite the first brachial, a third series starts in on the side. Other specimens show the normal *Poteriocrinus* arrangement of anals, the first plate resting between the upper angles of two basals, followed by two plates touching the adjacent radial, as explained above.

This species offers points of resemblance to several species of the genus, but it appears to be distinct, even allowing the great variation. As one feature after another is examined in the different specimens, such species as the Ohio *Scaphiocrinus subtortuosus* of Hall, the Burlington, *Scaphiocrinus fiscellus*, Meek and Worthen, and several others are recalled; but the species, taken as a whole, in its general features as well as in the details, appears most nearly related to *Poteriocrinus diffusus*, Hall, '62, 121, and *Pot.* ("*Scaphiocrinus*") *œgina*, H., '64, 57—the former from the Hamilton group of New York and the latter from the Waverly group of Ohio.

Prof. Hall has noted the resemblance of the two to each other; one point of difference is in the arm-plates. In the Hamilton species every second or third plate bears a pinnule, and "the intermediate joints are shorter than those bearing armlets."

The Waverly species bears pinnules from each plate.

The species under consideration shows considerable variation in this respect even on a single specimen. The writer has not had access to the types of the two species above referred to, but from study of the figures and descriptions, together with the fine series of specimens of *P. gregarius*, it would not seem unreasonable to expect that specimens may eventually be found uniting all three species into one.

Poteriocrinus (Decadocrinus) Zethus n. s. Pl. I, fig. 9.

Body turbinate, with two long, slender brachials to each ray. These long brachials, with the arms, form a narrow elongate head with subparallel sides.

Underbasals minute, height and width about equal. Basals ("subradials" of Hall), a little higher than wide, rounded hexagonal. Radials wider than high, rounded pentagonal, the upper edge nearly straight, but falling off a little at the corners, beyond the base of the first brachial, which is narrower than the greatest width of the radial.

Brachials, two for each ray, subequal in length, cylindrical, twice as long as wide, length of each about that of height of calyx; the second brachial expanded at the top with inclined faces for attachment of first arm-plates.

Arms short, slender, the plates few and fully twice as long as wide.

The arm bears a pinnule at the third joint; (or bifurcates at this point, the specimen is too imperfect to determine which).

Anals unknown.

Column rounded, relatively strong, not expanding under the calyx, composed of two kinds of joints, alternating regularly, from above, first a thin, then a subglobular joint, and not varying in size or proportion for the length of stem exposed.

Dimensions.—Diam. stem, 0.8 mm.; calyx, width, 2.2 mm.; calyx, height, 1.5 mm.; primary radial series, length, 3.5 mm.; second brachial, mean width, 0.7 mm.; first arm-plate, length 1.0, width, 0.3.

This species resembles *P. Nycteus*, Hall, '61, 120, but the brachials and arms are stronger, and the brachials longer in proportion to the calyx. The resemblance suggests the name for the species, *Zethus*, who was the grandson of *Nycteus.*

Locality.—Ithaca, N. Y.

Horizon.—? Portage group, from a loose slab near the the top of the Portage, and supposed to have fallen from the rocks just above where found.

In collection of Prof. S. G. Williams, Cornell University.

Taxocrinus Ithacensis n. s. Pl. I, fig. 10.

Body expanding moderately; calyx shallow, broad; arms strong, of medium length, the whole head rather slender for the genus.

Underbasals minute but appearing as a thin, irregular band above the last stem segment.

Basals small, low, subpentagonal.

Plates of the first radial series, strong, large, well developed.

Radials pentagonal, upper edge deeply sulcate, broader than high; articulation with first brachial narrower than the full width of plate; surface broadly convex.

Brachials, two for each ray. First brachial subquadrate, width and height about equal, wider at top than at bottom, upper margin broadly sulcate.

Second brachial, the largest plate of the body, expanding above, subpentagonal, upper margin angular.

Primary arm-plates, four (or rarely five) strong, about half the size of brachials; the arms branch twice (or three ? times); each branch of four or five plates.

Arm-plates convex, but not angular, about as high as wide; no pinnules seen; each arm-plate deeply sulcate on its upper edge for articulation with the following plate, the upper angle produced ventrally so as to appear subauriculate on a side view.

Stem strong, round; the joints under the calyx thin and crenulate at margins; the thickness increases gradually for half an inch downwards, then there appear two sets, one thick, one thin; the thick plates increase in thickness and become strongly convex; the thin disks finally appear to drop out, and the main part of the stem consists of long nearly cylindrical joints, only slightly convex, and united by finely serrate margins. The root is a simple, low, conical expansion of the end of the stem, and is found attached to the shell of *Spirifer lævis*, in several cases.

Dimensions.—Stem (just below calyx), diam., 2.9 mm.; width of calyx, 5. mm.; primary radial series, height, 4. mm.; second brachial, width, 2.8 mm.; first four arm-plates, length, 4. mm.; total length of body and arms, 20. mm.

Locality.—Ithaca, N. Y.

Horizon.—Portage group, *Spirifer lævis* beds.

Taxocrinus Ithacensis. var. alpha n v.

This variety is about half the size of the typical form of the species occurring three or four hundred feet below.

The arms are shorter, and attain only the second · bifurcation.

The stem, at the top, has but a few of the uniformly thin disks, the alternate sizes beginning to appear much nearer the base of the calyx (within a quarter inch) than in the typical form. Otherwise, the calyx—the shape and number of plates in the calyx and in the primary radials—the first series of arm-joints, four (rarely five)—the second series, four or five—their convexity, and all other characters observed (except the smaller, and slightly shorter, stunted form), are precisely as in the type specimens of the species.

In some specimens of this variety, one of the arms is observed to have but two primary radials, the other rays have three. This I can look upon only as a varietal character, as in the secondary series we generally see variation in each specimen from four to six joints.

Locality.—Ithaca, N. Y.

Horizon.—Chemung group, about three hundred feet above the *Spirifer lævis* beds of the Portage group

Taxocrinus curtus n. s.

In general appearance this species resembles variety *alpha* of *T. Ithacensis*, but is still shorter, and the calyx is very low and widely expanded.

The underbasals do not appear on the surface.

The plates of the primary radial series are striate, or subcarinate along the centre, with faint parallel striations each side, and the surface indistinctly granular; total length of the three is once and a quarter the width of the second brachial.

Basals relatively smaller, about the height of the radial.

Radial very short, broad, sublunate.

First brachial subquadrate, height less than the width, which is less than the width of the radial.

The second brachial is the largest plate of the body, wide, pentagonal, with two broad, oblique edges for attachment of arms.

The arm-plates are less deeply sulcate at the upper margin than in *T. Ithacensis* or in the variety *alpha*.

Primary arm-plates, four, or three, convex, subcarinate. The central striæ, or carinations, are continuous from the brachials to the end of the rays, diverging at each axillary plate. The stem is composed of two sets of joints, the one thick, the other thin, from the base downward and it does not expand at the top as in *T. Ithacensis*. The very thin plates with crenulate edges, occurring under the calyx in that species, are wanting, as are also the extra large joints occasionally appearing along the upper part of the stem.

At first sight the types of this species appeared like extreme varieties of *T. Ithacensis*, in the line of var. *alpha*, but upon close comparison it is observed that not only are the arms shorter and of fewer joints, but the whole body is more stunted, and the primary radials, as a whole, and the individual plates composing them are proportionately shorter and wider than in that species, and the striation of the plates is not observed in any of the specimens referred to *T. Ithacensis*.

As fossils are defined, this is doubtless a distinct species, but it would not be surprising if a larger series of specimens should reveal the fact that the characters upon which it is founded are of no more than varietal value.

Locality.—Ithaca, N. Y.

Horizon.—Portage group, *Spirifer lævis* beds.

Melocrinus Clarkei n s.

The shape of the calyx cannot be determined on account of the crushed condition of the specimens, but the shape and number of the plates agree so well with those of *M. Bainbridgensis*, H. and W., that it is probable that the shape was the same, *i. e.*. broadly turbinate. In size, also, the calyx agrees well with that species.

No underbasals appear.

The basals are low, wide and pentagonal.

The radials are more than double the size of the basals, height and width equal, or wider than high. The variation in the shape of this plate, in the several specimens upon the one slab, covers the extremes met with in the two species *M. Bainbridgensis* and *M. breviradiatus.*

The radial is followed by two brachials of smaller size, the first hexagonal, the second pentagonal and angular above, and each is about equal in height and width.

The second brachial supports two arm-plates (still within the calyx), nearly as large as the brachials, irregularly pentagonal and meeting at their inner edges.

Of the secondary radials, three are within the calyx, the second is about half as high as wide, the third is very short. The third pair of secondary radials together bear a strong arm, gradually tapering to a point, about three times the length of the calyx. It is broad, flattened on the back and longitudinally depressed along the centre, and is composed of a double series of very short plates, meeting at the centre and arranged in opposite (not alternate) order.

On the outer and ventral side the arm bears long, slender, cord-like branchlets, which appear to have fine thread-like appendages along their sides. In the central part of the arm these branchlets are as long as the arm itself. They proceed from every third arm-plate, instead of every fourth, as in *M. Bainbridgensis*, and the plates from which they appear are opposite each other, and their outer sides are lengthened slightly.

The interradials are apparently like those of *M. Bainbridgensis*, beginning with a large plate between the upper parts of two adjacent radials, followed above by two smaller plates, and these by more still smaller plates, the number or arrangement of which is not uniform.

The calyx-plates are marked by granulations over the central portion, are rounded at the margins, which in some cases are elevated slightly above the central part of the plate, causing a depression, as in *M. Bainbridgensis;* other plates (even on the same specimen) are convex, as in *M. breviradiatus.* The rows of fine ridges, connecting the calyx-plates at their juncture, are very distinct in some cases, and do not appear in others. The former is a character of *M. breviradiatus.*

The stems are composed of alternately thin and thick plates, the relative order, or proportions of which, are not constant, even varying on the same stem when preserved for long distance.

This species is closely related to *Melocrinus Bainbridgensis*, Hall and Whitfield, 1875, from the Huron shale, Bainbridge, Ohio, and to *M. breviradiatus*, Hall (figured on a plate of "New Crinoidea, Pl. 1," which was published, with explanation of plates, in 1872), from the Hamilton group.

The study of the specimens (all on a single slab), from which the above diagnosis is made out, has revealed the fact that apparently all the characters distinguishing the two species just named are variable in those specimens. The arms must be excepted; none are known for *M. breviradiatus*, and those described for *M. Bainbridgensis* were not found attached to any calyx.

While, therefore, we retain a distinct specific name for the specimens under consideration, we are led to believe that examination of a larger series of specimens may make it necessary to unite these three species in one.

Locality.—Ontario County, N. Y.

Horizon.—Genesee slate (? Portage group).[1]

This species was discovered several years ago, and by Prof. N. T. Clarke, of Canandaigua, N. Y., was brought to the notice of Prof. James Hall, who gave it the name "*Ctenocrinus Clarkei*," in honor of Prof. Clarke. But as no description or figure was made of the species we publish it as new under the specific name proposed by Prof. Hall.

Among the material collected by Prof. John M. Clarke from the Chemung rocks at Haskinsville, Steuben Co., N. Y., are two species of *Poteriocrinus*, belonging to the type of *P. Cornellianus*, but evidently distinct. The specimens are so imperfect that a satisfactory specific diagnosis cannot be made out, but we will record the characters which can be distinguished.

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[1] [The specimen above described belongs to the fauna of the Hamilton (not Chemung) period.

A second specimen, which I have not seen, came from Portage rocks; and this second specimen, Prof. J. M. Clarke informs me, is apparently the same species but has never been scientifically identified.] —H. S. W.

Poteriocrinus (*sp. secunda*).

Stem at the top strongly pentagonal, carinate and expanding.

Calyx small, rapidly expanding. Arms large, and arm-plates convex.

Underbasals small, low, broad, arched above, subpentagonal.

Basals a little higher than underbasals, and twice as wide as high.

Radial twice as large as basal, broad, sublunate, with the points turned upwards.

Primary radials very large, nearly as wide as the calyx below the radials, composed of short plates with straight sutures and of at least seven plates; the specimen is imperfect just before the bifurcation.

There are small, deep pits in the calyx at the lateral and upper angles of the basal-plates as if their corners had been abruptly bent in toward the centre. The upper part of the stem and the numerous primary radials are features resembling *P. Cornellianus;* but the specimen is fully twice as large; the calyx is much smaller and expands more rapidly, and the pittings of the calyx are peculiar.

Poteriocrinus (*sp. tertia*).

Stem roundish, subpentagonal near the top, with cirri standing out obliquely and straight from the stem, of which several appear within an inch below the base of the calyx.

Calyx low, small.

Underbasals cannot be distinguished, but evidently present and small.

Basals about as high as wide and nearly as large as the radials.

Anals unknown.

Radials subpentagonal; the insertion of the first brachial occupies the full width of the plate. There are six plates in the primary radial series; pinnules appear from the plates above the third. The sixth primary radial (the fifth brachial) is angular above and from it the ray bifurcates. On each side pinnules start from every alternate plate.

Pinnules short.

This resembles *Pot. Cornellianus*, but it is considerably larger, the stem is less strongly pentagonal at the top, and the primary radials are six, instead of eight or nine, as in that species.

The specimen is on a slab with *Dictyophyton.*

Locality.—Haskinsville, Steuben Co., N. Y.

Horizon.—Chemung group.

EXPLANATION OF PLATE I.

PAGE.

Figs. 1, 2 and 3. POTERIOCRINUS CORNELLIANUS.................... 18

1. Anterior view; showing calyx and lower part of arms.
2. Anal view; showing anal plates and ventral tube.

3 *a*. Another specimen; showing long ventral tube, a part of the calyx and one of the arms running under the ventral tube.

3 *b*. Section of ventral tube, dorsal view enlarged.

3 *c*. View of transverse section of the ventral tube.

3 *d*. Ventral view of same; showing the short furrows or lamellæ extending from the ventral longitudinal axis only part way toward the edge of the lateral fringe-plates.

Fig. 4. POTERIOCRINUS CLARKEI.................................. 21

The *three* arms proceeding from one of the distal brachial plates is exceptional; generally only two are seen for each ray.

Fig. 5. POTERIOCRINUS CLARKEI var. ALPHA........................ 22

Figs. 6, 7 and 8. POTERIOCRINUS GREGARIUS........................ 22

Fig. 9. POTERIOCRINUS ZETHUS.................................... 27

Fig. 10. TAXOCRINUS ITHACENSIS.................................. 29

a. Head and upper part of stem. *b*. A few joints from the central portion of the stem. This is the general character of the fragments of stems. *c*. Base of the stem, with the disk by which it is attached; in this case to the surface of a *Spirifer lævis.*

Figs. 1, 6, 7 and 10 are enlarged about once and one-half, and figs. 3 *b*, *c*, *d* and 8 are twice natural size.

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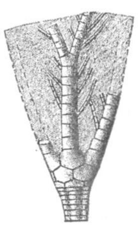

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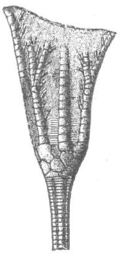

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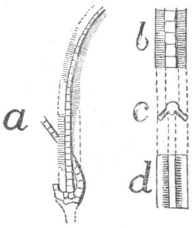

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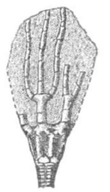

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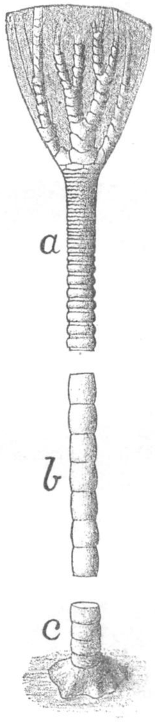

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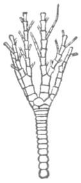

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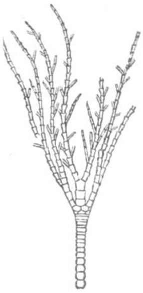

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WILLIAMS ON NEW CRINOIDS.